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# **Spatial epidemiology of lung cancer mortality in Andalucía, Spain: Geographical heterogeneity and risk-factors assessment**

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## **Abstract**

### *Background*

Cancer is the leading cause of mortality in Andalucía for both genders, and lung cancer is the main cause of mortality for men. Radon-gas exposure is the second most important cause of lung cancer after tobacco smoking. Radon-gas is a radioactive decay element, originating from radium. Presence in soil varies according to lithology (a surrogate for radon-gas exposure). Lithology can explain some lung cancer deaths. Tobacco smoking also causes larynx cancer and Chronic Obstructive Pulmonary Disease (COPD). However, lithology cannot explain deaths due to larynx cancer or COPD. The aims of this study were to understand spatial heterogeneity and to determine the effect of lithology on risk of lung cancer in Andalucía (Spain).

### *Methods*

Mortality data on deaths due to lung cancer, larynx cancer and COPD were extracted from the Andalusian mortality registry. Population and socio-demographic data were obtained from the Andalusian Statistics Institute. A small-area analysis was carried out using data for the period 1986-1995 from Andalucía. Structural Equation Modelling, via Bayesian regression analysis, was used to assess the associations between the spatial distribution of 25,006 lung cancer, 3,653 larynx cancer, 5,143 COPD deaths and lithology. Adjustment was made for area-level deprivation (a surrogate for tobacco smoking) within a Besag-York-Mollié model. These analyses were performed using Markov Chain Monte Carlo methods. Effects are reported as relative risks (RRs) and associated 95% credible intervals (CIs).

### *Results*

For males, the spatial distribution of lung cancer deaths (but not larynx cancer or COPD) was positively associated with lithology. These associations remained after adjusting for deprivation. The model used enabled separate estimation of risk due to lithology (RR = 1.023; 95% CI 1.015 to 1.031) and deprivation (RR = 1.040; 95% CI 1.033 to 1.048). For females, the spatial distribution of lung cancer deaths was not associated with lithology.

### *Conclusion*

The results from this study help to explain regional variability in lung cancer mortality in Andalucía. Variation in deprivation (assumed to be related to smoking prevalence) could not completely explain the observed geographical heterogeneity. The statistical analyses clearly demonstrated that lithology (i.e. radon gas) was an important factor related to the occurrence of lung cancer in males in this region. These findings could be used to inform local preventative measures.